FURTHER NOTES ON AUSTRALASIAN SHIPWORMS.

By C. Hedley, F.L.S.

The results of studies in the rather neglected branch of Australasian shipworms were published by this Society in Vol. ix. (2nd Series), pp. 465-6 and 501-5, Pl. xxxii. of these Proceedings. Attention having thus been drawn to the subject, Mr. T. Steel exhibited at the meeting of August 28th, 1895, specimens of a fine undescribed species from Fiji, forwarded to him by Mr. T. Ferguson from red gum (?) piles at Nausori Sugar Mill, on the Rewa River. One perfect example of these measured two feet in total length and fifteen millimètres across the valves when in natural apposition, and is therefore probably capable of causing much mischief. Mr. Steel informed the Society that, at the point where these were procured, the river was not only fresh enough to drink, but had been proved at intervals during two years' residence by his own analyses, made in reference to the manufacture of sugar, to be absolutely free from the least saline trace. The timber containing them had been erected for two years. By the kanakas who were employed to obtain these, the animals were greedily devoured raw. Mr. Steel generously presented this specimen to the Australian Museum that it might be reported on by myself. Being reluctant to cut up so superb and unique a specimen I delayed the examination of the species until the arrival of further material. By the good offices of the same kind friend such has now reached me from the Navua River, near the Tamunua Sugar Mill, Fiji, where the stream is somewhat brackish at high tide. Upon these the following account is based.

The present is not the only instance known of a shipworm flourishing in fresh water. Wright has published an interesting account of one, *Nausitoria dunlopei*,* which was proved to pass

* Trans. Linn. Soc. xxiv. 1864, pp. 451-4, Pl. xxiv.

the whole of its existence in perfectly fresh water in the Hurreegonga, an anabranch of the Ganges River, India; and which indeed is unknown elsewhere. Kirk noticed an undetermined species a hundred miles from the sea in the Zambesi River, S. Africa.*

A difficulty which at once confronted me in describing the novelty was to select the genus most appropriate for its reception. The accepted classification is based on the form of the palettes. Continued observation and reflection have persuaded me that these features are not deserving of that classificatory value at which Gould and Wright have estimated them. Their structure and position must expose them, before any other portion of the animal, to stress of modification in change of environment. The soft parts of the anterior trunk should be preferred to the hard in the choice of features to guide the systematist. An examination of published figures and of a considerable series of Australasian specimens shows me that the siphons of the *Teredidæ* are variously divided or united, and vary also in being surrounded or not by a cup-like outgrowth of the mantle. These are the features on which I rely for a clue to the natural division of the family.

The species under consideration cannot be included in the genus *Teredo* of Linné, for the type of that, according to the figures of Forbes and Hanley† and other writers, entirely lacks the cup-shaped mantle which here surrounds the bases of siphons and palettes.

Uperotus, Guettard, judging from the engraving of Griffiths,‡ differs by the siphons being united to the tips.

The animal of *Kuphus*, Guettard, is still unknown, but as Wright points out we may safely deduce from the shelly tube that the animal has the siphons separated for most of their length.

Nausitoria, Wright,§ however, conforms to the pattern under study, and in this respect does not differ from the previously

* Jeffreys, British Conchology, iii. 1865, p. 147.

† British Mollusca, 1848, Pl. F. fig. 1.

‡ Cuvier's Animal Kingdom, 1834, xii. Mollusca, Pl. xviii. f. 3a.

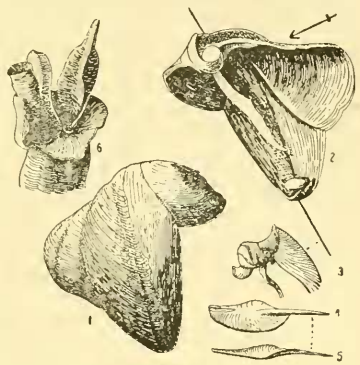
§ *Op. cit.* xxiv. p. 452.

described *Calobates*, Gould.* Another genus imperfectly known, but perhaps also to be ranked under *Calobates*, is *Lyrodus*, Gould, type *Teredo chlorotica*, Gould,† "from ships that have cruised in the Pacific."

CALOBATES FLUVIATILIS, n.sp.

(Figs. 1-6.)

For specific identification of the members of the genus *Calobates*, I rely on one part of the valve only,—the anterior section or auricle, of which the interior aspect is the characteristic. This portion of the valve (figs. 1-2) is that which in life is protected from friction by the soft parts, and whose development is not interfered with by the station of the animal. In the present species the anterior dorsal margin is straight and sloping, the anterior edge of the auricle is gently curved and meets the margin of the antero-median area at a wide angle. From the hinge process a spur is seen in profile, viewed from the anterior side, to project (fig. 3). The height of the valve figured is 10 mm, and the length the same. The remainder of the characters correspond to those of *(T.) edax* previously described in these Proceedings. The palettes (figs. 4-5) are usually much worn by friction; a well preserved specimen selected for illustration is 17 mm. in total length, straight and asymmetrical, the blade twice the length of the stalk, on one side the flat blade is hatchet-shaped, on the



* Proc. Boston Soc. Nat. Hist. viii. 1862, p. 283.

† Invertebrata of Massachusets, 1870, p. 34, fig. 360. Tryon considers (Structural and Systematic Conchology, iii. 1884, p. 123) that *Lyrodus* may belong to *Nausitoria*. Indeed it is possible that *chlorotica* may be *saulii*.

reverse it bears a blunt point. In this respect it recalls the "Jedburgh Axe," a weapon of ancient Scottish warfare. The stalks of the palettes are embedded in the muscles of the anterior trunk, one on each side, close to the base of the conjoined siphons. The sketch (fig. 6) shows the mantle-cup ripped open and one palette removed and the other *in situ*. Fragments of the tube before me show no choke of imbricating plates. A piece of eucalypt timber, a foot in length, is riddled with numerous, close, fairly straight burrows, 12 mm. in diameter, lined by thick shelly tubes.

Hab.—Rewa and Navua Rivers, Viti Levu, Fiji.

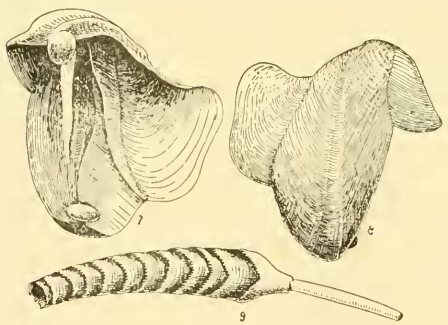
Type to be preserved in the Australian Museum.

The study of the foregoing novelty induced a review of the information amassed since the publication of my previous article on the subject of Australasian shipworms. Mr. Gerald Halligan has kindly placed at my disposal complete specimens of shipworms found boring wharf piles in Circular Quay and Woolloomooloo Wharf, Sydney. Among these I observe,

Calobates saulii, Wright.

(Figs. 7-9.)

described from Port Phillip, Victoria.* The peculiar palettes (fig. 9) give to this a ready means of recognition. The incomplete specimen figured is 14 mm. long, of which the broken blade is twice the length of the stalk, flat on the inner side, rounded on the outer; the blade consists of a series of imbricating joints, each expanded distally and embracing in pectinate jaws the following joint.



* Trans. Linn. Soc. xxv. 1865, p. 567, Pl. lxv. ff. 9-15.

The valve (figs. 7-8) is distinguished by a broad and deep auricle, truncated anteriorly and curved in to meet the antero-median margin at an acute angle. The example before me measures 7 mm. in height, and in length the same. So far as my experience goes *C. saulii* never approaches the size of *(T) edax*.

The anterior portion of the animal possesses the cup-like process of the mantle like that figured and described for *C. fluviatilis*, and I accordingly transfer it to *Calobates*. Wright has figured the same feature in *Kuphus* (?) *mannii*,* and I therefore follow Tryon† in placing it also in *Calobates*. This character is again apparent in Wright's figures of *Nausitoria dunlopei*,‡ *Calobates australis*,§ and *C. thoracites*.‖

I am much indebted to Prof. Ralph Tate for an opportunity of examining authentic specimens of his *Teredo fragilis*.¶ This has left me no doubt that *T. fragilis* is a synonym of *C. saulii*, to which the unfigured valves quite correspond. The apparent difference in the palettes is due to the fracture of the specimens figured, wherein all joints but the basal one have been snapped off.

Miss Lodder has sent me specimens of *C. saulii* from the entrance of the Tamar River, and Sandford, Tasmania, and Mr. G. B. Pritchard from Beaumaris, Victoria. I have also seen it from the Bellinger River, N.S.W.

Besides *C. saulii*, Mr G. Halligan's series of Sydney shipworms also embraced examples of *Teredo edax*, Hedley, a species which I now wish to include in *Calobates*, since these entire animals possess the character above emphasised, which appears to me to distinguish the genus.

I have also had brought under my notice valves of *Teredo australarctica*, Hutton, from Port Stephens, N.S.W., a habitat which requires confirmatory evidence. Probably this species should follow others into *Calobates*. In a list of Victorian Mollusca

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* *Op. cit.* xxv. Pl. lxv. f. 5.

† Am. Journ. Conch. iii. 1867, Suppl. p. 19.

‡ *Op. cit.* xxiv. Pl. xlvi. f. 2.

§ *Op. cit.* xxv. Pl. lxiv. f. 1,

‖ *Op. cit.* xxv. Pl. lxiv. f. 7.

¶ Trans. Roy. Soc. S.A. 1888, p. 60, Pl. xi. ff. 13a, 13b, 13c.

recently published by Mrs. Kenyon, the error of ascribing the local shipworm to a European species is again repeated.

At Oubatche, New Caledonia, I was shown by Madame Du Bois, the local postmistress, several tubes of *Kuphus arenarius*, which she informed me had been obtained from the reefs in that neighbourhood. This is an interesting extension of the previously recorded range.

Summary.—The soft parts rather than the hard should be taken as a guide in a classification of the shipworms. A salient character is the cup-like process of the mantle which embraces both siphons and palettes; the siphons differ in the extent to which they are divided.

The genus *Calobates*, Gould, is hereby remodelled and characterised by a cup-like anterior fold of the mantle and short siphons divergent for half their length. It thus embraces Wright's *Nausitoria*, possibly Gould's *Lyrodus*, and species referred to other genera.

A new species, *Calobates fluviatilis*, from Fiji is distinguished by the rounded and produced auricle of the valve, and by the hatchet-shaped palettes.

The shipworms at present recorded from temperate Australia are :—*Calobates australis*, Wright, from Fremantle, W.A. ; *C. saulii*, Wright (to which *Teredo fragilis*, Tate, is reduced), from Adelaide, Melbourne, Launceston, Sydney and the Bellinger River, N.S.W.; *C. edax*, Hedley, from Adelaide and Sydney, and doubtfully *Teredo (? Calobates) antarctica*, Hutton, from Port Stephens, N.S.W.

EXPLANATION OF FIGURES.

Calobates fluviatilis, Hedley.

Fig. 1.—Exterior aspect of right valve.
Fig. 2.—Interior aspect of the same.
Fig. 3.—Hinge process, viewed anteriorly.
Fig. 4.—Palette, seen from the side.
Fig. 5.—The same, edgewise.
Fig. 6.—Anterior extremity of trunk, with one palette removed, and the mantle slit, to show the relative positions of siphon and palette.

Calobates saulii, Wright.

Fig. 7.—Interior aspect of right valve.
Fig. 8.—Exterior aspect of the same.
Fig. 9.—Palette.

All magnified, and to various scales.